

Claims

We claim:

- 5 1. A method of monitoring the condition of a thermal barrier coating within a turbine engine having an operating temperature in excess of 1200 °C, said method comprising:
- embedding and thermally protecting a fiber lead into the thermal barrier coating;
- 10 embedding at least one fiber Bragg grating sensor into the thermal barrier coating such that the fiber Bragg grating is affected by a thermal or mechanical expansion of the thermal barrier coating; and
- using the thermal or mechanical expansion of the thermal barrier coating or the changing of a refraction index of the fiber to determine changes in temperature
- 15 or strain of the thermal barrier coating.
2. A method of monitoring according claim 1, wherein the fiber lead is thermally protected by placing into a thin stainless steel or Nickel tube.
- 20 3. A method of monitoring according claim 2, wherein the fiber Bragg grating is placed into the thin stainless steel or Nickel tube.
4. A method of monitoring according claim 2, wherein the thin stainless steel or Nickel tube is filled with air or a soft heat resistant filling material.
- 25 5. A method of monitoring according claim 1, wherein the fiber lead is placed into a thin hole of the substrate.
6. A method of monitoring according claim 3, wherein the fiber Bragg grating is
- 30 placed loose in the tube.
7. A method of monitoring according claim 6, wherein the fiber Bragg grating is placed by a helical winding in the tube.

8. A method of monitoring according claim 6, wherein the fiber Bragg grating is placed meander like in the hole.

5 9. A method of monitoring according claim 5, wherein the fiber lead is placed loose in the hole.

10. A method of monitoring according claim 9, wherein the fiber lead is placed by a helical winding in the hole.

10 11. A method of monitoring according claim 10, wherein the fiber lead is placed meander like in the hole.

12. A method of monitoring according claim 1, wherein the fiber lead or the fiber Brag gratings are embedded inclined to the surface of the thermal barrier coating or a
15 metal component to which the thermal barrier coating is attached.

13. A method of monitoring according claim 12, wherein the fiber lead or the fiber Brag gratings are embedded in the thermal barrier coating and a metal component to which the thermal barrier coating is attached.

20 14. A method of monitoring according claim 1, wherein the monitoring is performed real-time or near real-time.

15. A method of monitoring according claim 1, wherein the fiber Bragg grating
25 sensor is mounted on or within a carrier.

16. A method of monitoring according claim 15, wherein the carrier is a ceramic carrier.

30 17. An apparatus for monitoring the condition of a metal component, said apparatus comprising:

a fiber lead embedded into the metal component;

at least one fiber Bragg grating sensor embedded into the metal component, such that the fiber Bragg grating is affected by a thermal or mechanical expansion of the metal component; and

5 a mechanism using the thermal or mechanical expansion of the metal component or the changing of a refraction index of the fiber to determine changes in temperature or strain.

10 18. An apparatus according claim 17, wherein the thermal barrier coating or the metal component are within a turbine engine.

19. An apparatus according claim 17, further comprising devices for real-time or near real-time measurement.

15 20. An apparatus according claim 17, further comprising a light source which provides an incident spectrum which covers all wavelengths of the sensors.

21. A metal component within a turbine engine, comprising:
a fiber lead embedded into said metal component;
at least one fiber Bragg grating sensor embedded into said metal
20 component, wherein the fiber Bragg grating is affected by a thermal or mechanical expansion of the metal component;
a light source which provides an incident spectrum which covers all wavelengths of the sensors; and
a mechanism adopted to use the thermal or mechanical expansion of the
25 metal component or the changing of a refraction index of the fiber to determine changes in temperature or strain of the metal component.

22. A metal component according claim 21, wherein the metal component is coated with a ceramic thermal barrier coating.